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Navy aviators require current, accurate, and easily accessible digital chart data to drive aircraft moving-map displays and provide enhanced situation awareness in the cockpit. In support of this requirement, scientists from the Naval Research Laboratory have developed a software tool known as the Moving Map Composer (MMC) to help pilots and mission planners design and build mission-specific, digital, aeronautical chart coverages. MMC plays a major role as a human-computer interface by enabling pilots to effectively perform a wide variety of aeronautical chart planning functions, including the design and construction of chart images from user-specified data for use in mission planning systems and in-flight moving-map displays. This poster provides an overview of MMC and describes how its development and enhancements are driven by user needs.

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# The Moving-Map Composer: A GUI-Based Map Design System for Navy Aviators

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ABSTRACT

Navy aviators require current, accurate, and easily accessible digital chart data to drive aircraft moving-map displays and provide enhanced situation awareness in the cockpit. In support of this requirement, scientists from the Naval Research Laboratory have developed a software tool known as the Moving Map Composer (MMC) to help pilots and mission planners design and build mission-specific, digital, aeronautical chart coverages. MMC plays a major role as a human-computer interface by enabling pilots to effectively perform a wide variety of aeronautical chart planning functions, including the design and construction of chart images from user-specified data for use in mission planning systems and in-flight moving-map displays. This poster provides an overview of MMC and describes how its development and enhancements are driven by user needs.

## 1. INTRODUCTION

MMC is comprised of a series of Graphical User Interfaces (GUI) that simplify complex tasks such as data fusion, chart design, editing, and file management (Lohrenz et. al., 2000). The main MMC GUI (figure 1) is comprised of a menu bar, title information, a world map workspace, and tool boxes. The menu bar provides options with submenus that perform most of MMC's functions. Title information is listed below the menu bar and contains data regarding the composition that includes a descriptive title, a unique composition file name, a library identification number, chart scale, composition type, and creation date. The largest portion of the main GUI is a world base map on which to design Aircraft Optical Disk (AOD) and Mission Planning System (MPS) compositions. A group of tool boxes, located at the window bottom, include a coverage definition box with buttons for defining chart coverages (via stretch box, polygon vertices or Latitude/Longitude coordinates), a zoom box, a map projection selection box and, a chart series and scale selection box.

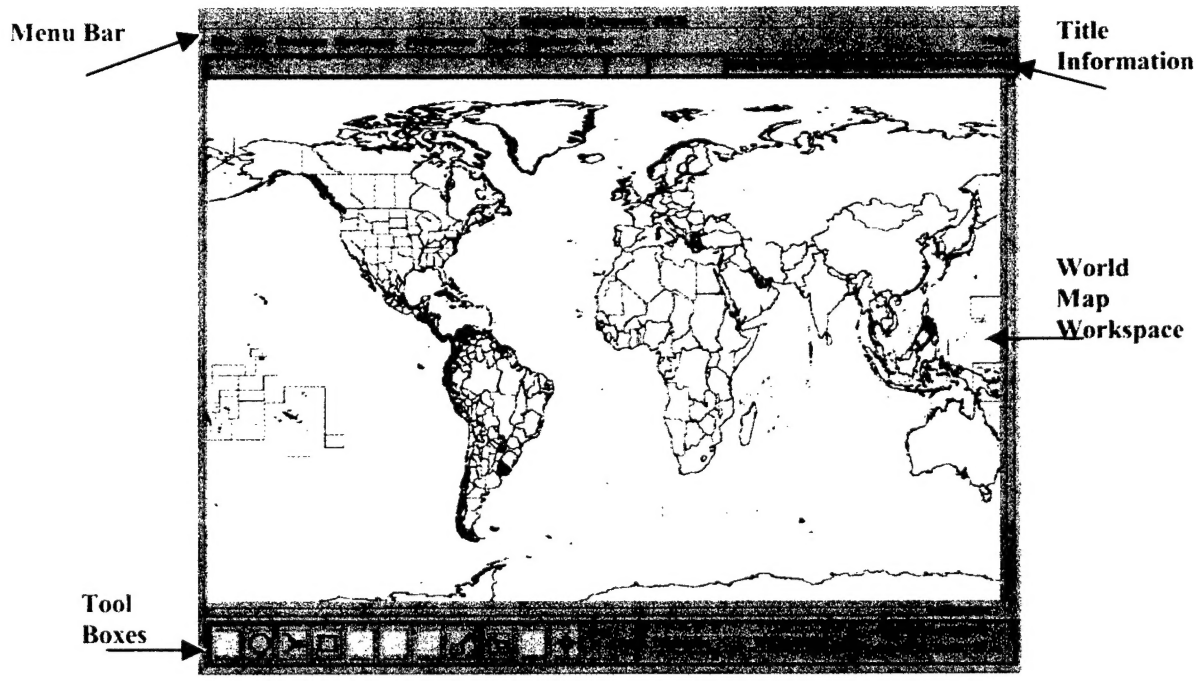


Figure 1. Main MMC GUI

## 2. APPROACH

MMC is implemented as a standalone system on a Compaq Alpha workstation running OpenVMS. A new version of MMC (due to be released in late 2001) will operate on a PC platform running Linux. Peripheral devices for performing optical disk operations are included as part of the system hardware configuration. MMC is an X-Windows based system that is comprised of C and OSF/Motif programming languages. Figure 2 is a simplified diagram of principal operations: the MMC user inputs primary data sources (Compressed Aeronautical Chart (CAC) data, Digital Terrain Elevation Data (DTED), and scanned paper charts), from which Mission Planning System data and Aircraft Optical Disk data are processed and archived. Both CAC and DTED data are available from the National Imagery and Mapping Agency. Paper charts are scanned and stored in CAC format and used to augment existing CAC data.

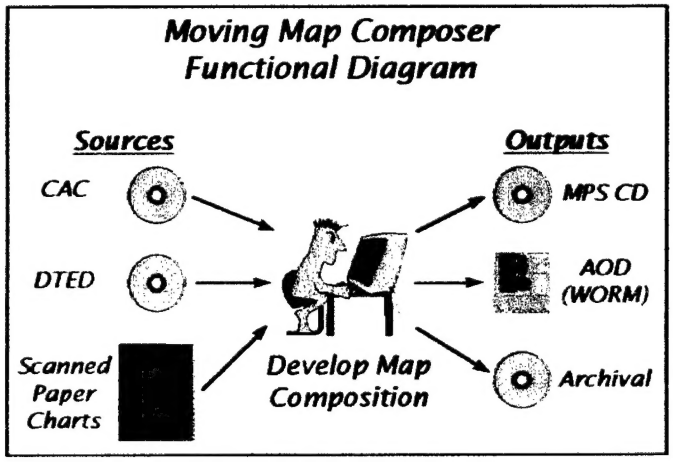


Figure 2. Primary MMC software functions.

### 2.1 GUI Designs

While MMC functionality is driven by needs of users in the fleet, GUI design and development is driven by the challenge to create human-computer interfaces that streamline operational tasks and incorporate intuitive approaches and logical methodologies. Since the initial release of version 1.0, MMC users continue to provide feedback and requirements for additional support tasks and enhancements. Some of these enhancements include paper chart scanning, and checklist editing and managing. Three types of GUI designs are used to implement MMC functionality. These include generic task designs, specific task designs, and icon designs. Generic task designs are broad in concept and easily tailored to specific uses. For example, a Percentage GUI (figure 3) has been modified for use in scanning paper charts to depict the percent of task completion. Similarly, a File Selection GUI is modified to depict appropriate file directories.

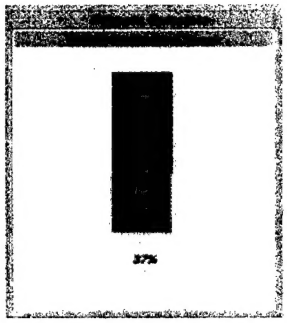

Figure 3. Percentage GUI

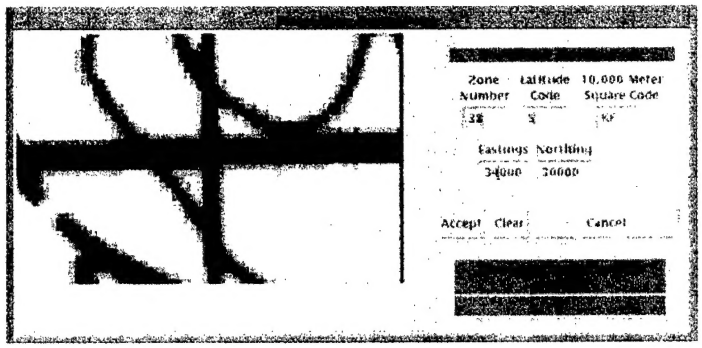


Figure 4. Control Point Entry GUI

Specific task GUI designs are tailored to address the particular function being performed. In chart scanning, a Control Point Entry GUI (figure 4) has been designed and developed to acquire geographic coordinate control points for georeferencing the newly scanned image. The scanning task required additional GUI development for viewing scanned data, obtaining Datum and Ellipsoid combinations and for clipping the scanned image. These GUIs are used together to simplify many of the tasks associated with chart scanning that were previously labor intensive and tedious. MMC also provides an editor (figure 5) for creating and modifying checklist sets. This editor is comprised of both generic and specific GUI designs. Tool boxes that rely on button icons have been designed to depict the tool's function. The coverage definition tool box uses icons for selecting a coverage area, and for defining an area of coverage (figure 1). The most recent enhancement includes a checklist manager that has been developed to easily allow users to manage all of the multiple files that are associated with checklist sets (figure 6). The manager allows users to visualize an entire checklist set within a relative context and offers features for manipulating individual checklists within a set including editing functions such as copying, and deleting.

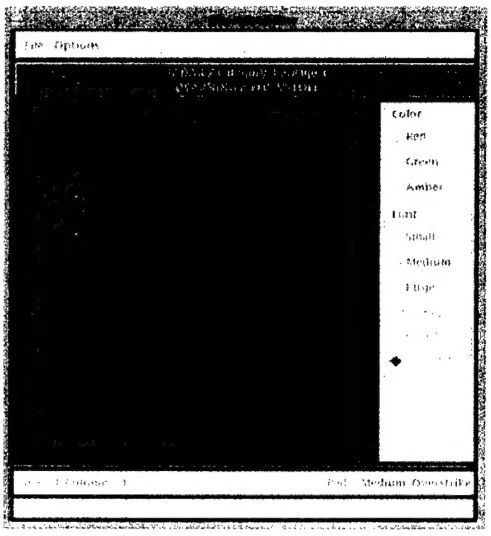

Figure 5. Checklist Editor

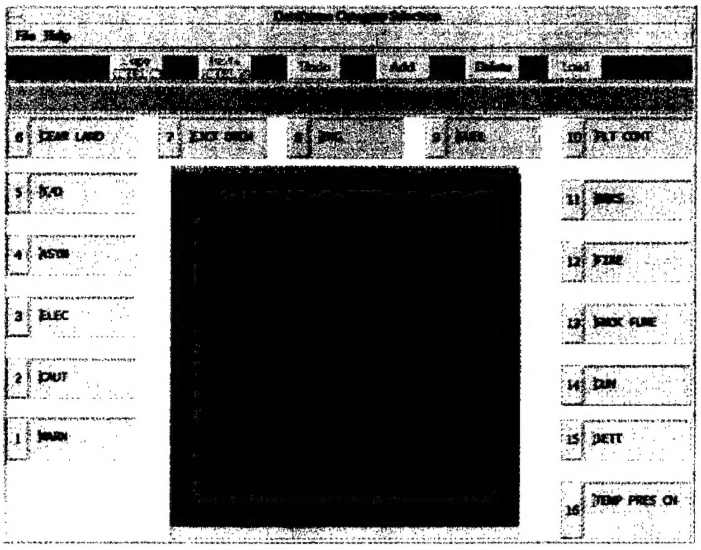

Figure 6. Checklist Manager

## 3. SUMMARY

MMC provides mission planners and pilots with a tool for designing and building mission coverages. The effective use of GUI designs has simplified complex tasks and through scanning, made more source data available for use. Editing tools for chart coverages and checklists enable modifications to be easily performed. Another benefit is that new and inexperienced users are more easily trained and less likely to make mistakes. As a result, MMC has facilitated products that are both current and accurate. MMC is part of an iterative cycle of product design, test and development. Pilot surveys and product evaluations gather user preferences that drive requirements for new data types and inspire enhancements to both MMC and cockpit display systems that, in turn, provide improved tactical situation awareness to the aviator. MMC has undergone numerous revisions since its inception to provide increased support to the fleet, and the system now is in greater demand by both U.S. and foreign militaries, including Spain, Italy and Finland.

## 4. ACKNOWLEDGEMENTS

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Lohrenz, M.C., et.al., (2000) AV-8B Map System II: Moving Map Composer (MMC) Version 3.3, Software User's Manual, 2nd Edition. NRL Report FR/7440-00-9938. NRL, Stennis Space Center, MS. June